ART. I. A NEW SCIURAVUS FROM UTAH

By J. J. Burke

The new species of *Sciuravus* described in the following pages was discovered by the writer in 1931 in the course of explorations of the Eocene strata of northeastern Utah by a Carnegie Museum paleontological field party. Associated with this specimen were various other mammalian fossils, a preliminary list of which was given in a previous paper.[1] The illustrations which accompany this article are the work of Mr. Sidney Prentice.

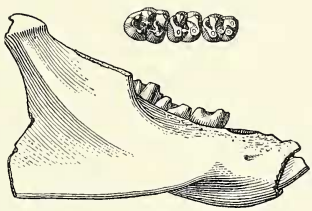

Fig. 1. *Sciuravus eucristadens* Burke. Lateral view of the mandibular ramus and occlusal view of RM_{1-3} of the holotype, C. M. no. 11871. × 2.

Order SIMPLICIDENTATA Lilljeborg

Family SCIURAVIDÆ Miller and Gidley

Genus Sciuravus Marsh

Sciuravus eucristadens sp. nov.

Holotype: Right mandibular ramus with the incisor and three molars in place, Carnegie Museum Cat. Vert. Foss. no. 11871.

Horizon: Green River Eocene Series.

Locality: About two miles southeast of Powder Springs, Uinta County, Utah (Sec. 8, T.7S., R.25E. S. L. M.).

Diagnosis: Near *Sciuravus undans* Marsh in size; blade from en-

[1]Burke, J. J., "Preliminary Report on Fossil Mammals From the Green River Formation in Utah." Ann. Carnegie Museum, Vol. XXV, art. III, pp. 13-14, 1935.

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toconid extended to hypoconid to form hypolophid[2] in M_{1-2}; blade from entoconid connected by tubercle with ectolophid in M_3; posterior spur from protoconid reaching floor of central valley in M_2, connecting with tubercle in floor of central valley in M_3; central valleys crowded; relatively wide posterior valleys in M_1 and M_3; stylids absent from exits of external and central valleys; M_3 considerably larger than M_1 or M_2; cusps and crests in general robust, predominant over basins.

The mandibular ramus of this specimen is found to be light and slender when compared with those of other specimens of *Sciuravus*, but much of this is doubtless correlated with the age of the specimen (M_3 is scarcely worn, and P_4 was probably not yet securely anchored in place, and in consequence was lost from the ramus). The mental foramen is situated a little anterior to the alveolus for P_4. The masseteric fossa extends forward beneath M_1, but is well defined, despite the youth of the animal. The angle in general conforms rather well to that of the specimen figured by Matthew (Bull. Amer. Mus. Nat. History, vol. IV, p. 59, fig. 13, 1910) as of *Sciuravus nitidus*. The coronoid process is broken away at the base, but the fracture indicates that it was long antero-posteriorly. The ascending ramus rises to a moderate height, and the condyle is somewhat compressed transversely, anteriorly. The dental foramen pierces the ramus near the level of the tooth row. The inferior border of the angle is thickened, and shows no marked deviation from the plane of the ramus, although it is slightly bent medially.

The incisor is broken away a little below the superior alveolar wall. The tooth is of the slender type characteristic of early incisor growth; the anterior face shows the tendency toward flattening found in the incisors of *Sciuravus* from the Bridger Eocene.

The diastema is short, and seems to agree essentially with that found in Bridger specimens.

The P_4, as indicated, has been lost, but the alveolus would indicate that it was near M_1 in size.

The first molar is a rectangular tooth, in this respect agreeing with *Sciuravus undans* Marsh. The main cusps are well developed, and alternating, those of the paramere being somewhat in advance of the cusps of the protomere. The protoconid and the hypoconid have to

[2]The term "hypolophid" as used here and in subsequent places in this paper, is employed in essentially the same sense as by E. L. Troxell in Amer. Jour. Sci., ser. 5, V. art. 32, pp. 386-387, 1923.

some degree preserved their entity as crudely conical cusps, and have not yet merged well with the connecting crests. The entoconid resembles an asymmetrical pyramid; it is drawn out along the buccal edge to form a robust hypolophid blade which extends to the hypoconid. Similarly, the blade of the metaconid extends toward the protoconid. A mesoconid is present, and from the hypoconid a hypoconulid crest curls postero-internally.

A central valley, rather than a basin, is distinguishable; the steep slopes of the entoconid and metaconid eliminate the basining which to a degree characterizes this part of the molar crown in Bridger specimens of *Sciuravus*.

The posterior valley is considerably wider, antero-posteriorly, than in *Sciuravus* generally, and is more basin-like than the central valley.

The anterior valley, as such, is slight. The blade of the metaconid, as noted above, extends toward the protoconid, and is directed as though it were to connect with the protoconid between the prongs of two spurs from that cusp, one of which is directed postero-internally, the other antero-internally. It is the latter spur which finally connects with the metaconid, however, and the junction is made with the anterior flank of the metaconid, rather than in line with the blade. The posterior spur from the protoconid is prominent, short and stubby. It extends toward the central valley, though not enough to impede the latter, and is rather too intimately associated with the protoconid to be said to descend on the flank of the metaconid. The anterior valley, therefore, is confluent with the central valley, although its floor proper is considerably higher than that of the latter.

The mesoconid in this case is a distinct cusp, despite its connection with both protoconid and hypoconid. It is roughly lozenge-shaped, with its anterior and posterior angles connecting with the protoconid and the hypoconid respectively. Internally, it pushes somewhat into the central valley, and its external angle has the effect of bifurcating the external valley. The posterior branch of the external valley is the stronger.

The hypoconulid crest shows a decided bowing posteriorly, which broadens the posterior valley, but the latter is again narrowed toward its internal exit. Near the hypoconid a small tubercle, marked off by notches, shows on this crest.

The M_2 of this species is a larger tooth than M_1, and has more of a square outline. There is less alternation of protomere and paramere

cusps, and the cusps of the protomere show greater fusion with their connecting crests. The metaconid is enlarged over that in M_1, the entoconid reduced. The hypolophid blade of the entoconid is more crest-like, while the blade of the metaconid is more extended buccally and thinner. The central and posterior valleys are deeper, but the posterior valley is narrower than in M_1. The lingual cusps are more crowded at the outlet of the central valley than in M_1.

As in M_1, while the blade of the metaconid is directed toward the protoconid, the actual connection with the latter cusp is made by way of the anterior spur from the protoconid, which meets with the anterior metaconid flank.

The posterior spur from the protoconid here reaches to the floor of the internal valley. The spur is crudely robust, rather than delicately attenuate, and crowds the central valley. As in M_1, the anterior valley is confluent with the central valley, but in M_2 a gutter or channel joins the two.

The mesoconid still preserves its identity, although it is now triangular, rather than lozenge-shaped, having lost the angle which intruded upon the central valley in M_1. The protoconid and the hypoconid each connect with an angle of the triangle, while the third angle bifurcates the external valley. The posterior branch of the external valley is now cutting back to such an extent as to tilt the mesoconid obliquely to the antero-posterior plane of the tooth.

It is to be noted that in this tooth the hypolophid crest from the entoconid, transversely directed for most of its course, is sharply deflected posteriorly near the hypoconid to make the connection with the latter cusp. Anterior to the point of deflection there is some swelling of the crest toward the central valley, vaguely suggestive of a tubercle.

The hypoconulid crest is less bowed posteriorly in this tooth than in M_1, and the posterior valley, as mentioned above, is narrower. There are still indications, near the hypoconid, of the tubercle and grooves found on the crest in M_1.

The last molar of this specimen is a large tooth—considerably larger than either M_1 or M_2, and relatively larger than the last molar of any other specimen of *Sciuravus* that I recall having seen, despite frequent size variations that are found in this tooth. It is also quite a distinctive tooth as regards pattern, but unfortunately, variations in

the pattern of M_3 of *Sciuravus* are all too common. In the present instance, doubtless some of the characteristics of the pattern are of specific value, but without a more extensive series of specimens than is at my disposal I hesitate to attempt distinguishing them. The tooth approaches M_2 in outline. The alternation of the trigonid cusps is somewhat less distinct. The fusion of the protomere cusps with the connecting crests is much more complete than in M_1 or M_2. As compared with the condition in M_2, the metaconid has continued to enlarge, while the entoconid is reduced.

The hypolophid in M_3 does not consist of a continuous blade attenuated from the entoconid to the hypoconid. There is an extension of the entoconid wall transversely toward the protomere, but it is a short blade; it is connected with a tubercle-like cusp which in turn connects, not with the hypoconid, but with the ectolophid. The anterior valley is more prominent than in M_2. The central valley is about as deep as in the latter molar, while the posterior valley is much wider than in M_2. There is less crowding of the paramere cusps at the outlet of the central valley than in M_2. The posterior valley of M_3 is also deeper than the central valley of M_3. As in M_2, the blade of the metaconid extends toward the protoconid throughout most of its transverse course, but near that cusp it is diverted anteriorly to join with the anterior protoconid spur or crest.

The posterior spur from the protoconid is rather unusual. The spur proper reminds one of that found in M_1, although it is less prominent. It is, however, a short, stubby process, extending postero-internally. This short spur in turn is connected with a tubercle which arises from the floor of the central basin. The tubercle and the spur have fused to the extent of resembling a single crest, which still preserves the identity of its primary elements. The tubercle crowds the central valley, and crowds against the flank of the metaconid. The spur and the tubercle give the channel descending from the anterior valley something of a winding course and an uneven floor.

Although it is still possible to make out vaguely the mesoconid element, the entire connection between the protoconid and the hypoconid is best referred to as the ectolophid. The latter is now elevated into a crest approaching the level of the main protomere cusps, and is disposed more obliquely to the antero-posterior axis of the tooth than were the mesoconid-ectolophid elements in M_2. The anterior branch of the external valley is now practically non-existent, while the pos-

terior branch cuts well postero-internally, anterior to the hypoconid, in the same direction as the posterior valley.

The "hypolophid" tubercle, which connects the (in this tooth) short blade of the entoconid with the ectolophid, joins the ectolophid just anterior to the branch of the external valley. In addition to sending out spur-like connections with the entoconid blade and the ectolophid, this tubercle is somewhat elongated antero-posteriorly; it sends a short spur forward into the already crowded central valley and another posteriorly into the posterior valley. Both spurs die out in the valleys without making further connections.

The hypoconid blends into the hypoconulid crest, the two together making up the high postero-external wall of the crown. The crest is obliquely directed in this part of its course, roughly paralleling in direction the course of the combined posterior protoconid spur and tubercle. Postero-internally, however, a large, cusp-like tubercle conjoins with the crest, diverting the outlet of the posterior valley more anteriorly, and forming an anteriorly bending continuation of the crest. At its junction with the tubercle, the crest is raised into the semblance of a smaller tubercle, and small denticulations show on it nearer the protoconid.

There are certain details of the molar pattern of this species that are of interest. The trend of the posterior spur from the protolophid, for example, is somewhat unusual, even for *Sciuravus*. The fact that it is connected with the tubercle in the central valley in M_3, suggests rather strongly the mode of formation of the spur in M_2, *i.e.* that the protolophid element and the tubercle have fused to form the spur. There is, however, little to indicate such fusion in the spur in M_2 beyond the rather marked uniform thickness of the latter—a character which one would not expect to find in a single spur extending its reach. In M_1 there is no indication of the tubercle in the central valley.

A second feature of the pattern to be noted is the "hypolophid" tubercle of M_3. The latter connects the hypolophid blade of the metaconid with the ectolophid, rather than with the hypoconid; there may be some indication of the tubercle in M_2, although the connection is with the hypoconid; but in M_1 the hypolophid has much of the appearance of being an element entirely of entoconid origin, and connects with the hypoconid.

There are specimens in the Carnegie Museum collections from the

McCarty's Mountain Oligocene, which have been referred to *Ischyromys*, and which show resemblances to these pattern details in the lower molars of the species under description. The Oligocene forms show, in M_3, the spur from the protoconid connected with a tubercle in the central valley; the same condition, moreover, is found in M_2, but in M_1 the spur alone seems represented, and it does not extend into the central valley. In other words, the pattern details in the lower molars of the Oligocene forms are essentially the same as in *Sciuravus eucristadens* m., with the difference that in the Eocene form, there is no central valley tubercle distinct from the protolophid in M_2; also, it should be emphasized that in the McCarty's Mountain specimens, in all three molars, there is a decided tendency for the protolophid spur to extend across to the metaconid flank, rather than directly toward the central basin. Nevertheless, in M_{2-3}, the side of the spur flanking the central valley connects with the central valley tubercle.

There is also well shown, in M_3 of these Oligocene specimens, a tubercle, connecting the blade of the entoconid with the ectolophid. This tubercle can be distinguished, not alone in M_3, but on the remainder of the cheek-teeth, including P_4. In M_2 of one specimen it shows as a distinct conule except for its junction with the entoconid blade, but its usual behavior in the cheek teeth is to connect with the ectolophid.

The fact that in M_3 in *Sciuravus eucristadens* m., and in the last molar in the McCarty's Mountain Oligocene species, we find the entoconid blade connecting with the ectolophid by the way of a tubercle, raises the question as to what was the earlier condition of the protomere connections of the entoconid in M_{1-2} of *Sciuravus eucristadens* m. In M_2 of this species, as I have noted, there is a swelling on the connecting crest which might represent the tubercle, whereas in M_1 the crest connecting with the hypoconid has much the appearance of originating from the entoconid. However, this does not mean that the tubercle has not been present in the past history of the tooth; on the contrary, it may have been present and may have undergone complete fusion with the crest, or it may have been suppressed. In any case, I believe there are good grounds for suspecting that this tubercle, which joins with the spur from the entoconid in the lower molars of the form from the McCarty's Mountain Oligocene, may well represent the condition in this region of the molars of *Sciuravus eucristadens* m.

during the past history of M_1 and M_2, as it has and still does in M_3 of the latter species.

Something of this sort might also be said of the combined posterior protoconid spur and central valley tubercle of the molars of the species from the McCarty's Mountain Oligocene. Although there is no definite evidence that the long spur running into the central basin from the protoconid in M_2 of *Sciuravus eucristadens* m. is composed of the posterior protoconid spur and central valley tubercle (the elements found in M_3 of *Sciuravus eucristadens* m.) nevertheless the peculiar thickness of the long spur in M_2 is strongly suggestive of the former existence of both elements which have now fused to form one. If such has been the case, then the posterior protoconid spur and the central valley tubercle found in M_2 of the McCarty's Mountain Oligocene "Ischyromys" specimens may also represent the retention of a pattern feature once found in the previous history of M_2 of *Sciuravus eucristadens* m.

It is most interesting to note that in both the form from the McCarty's Mountain Oligocene, and in *Sciuravus eucristadens* m. the central valley tubercle is not represented in M_1. The posterior protoconid spur of this tooth is short and rather stubby, and has no connection with the floor of the internal basin. This suggests the possibility that the central valley tubercle was not present in M_1 of either form at the time of their derivation from a common ancestral form, although it might also be pointed out that the tubercle could have been present in both, and have been independently lost through suppression.

The tooth pattern details touched upon here suggest a fertile field of investigation not only as regards the ultimate relationships of the *Sciuravidæ* and the *Ischyromyidæ*, but also in respect to the various elements making up the *Ischyromys* pattern. Involved is the problem of reducing the *Ischyromys* pattern to some of its basic elements and the tracing out of the fate of these components in the various groups in which the pattern is found. It would not be surprising if intensive study of such details of the *Ischyromys* pattern would reveal characters of considerably more taxonomic importance than has generally been attributed to these minutiæ.

Other than in tooth pattern proper, and in the rather unusual size of M_3, the species seems to differ from the known Bridger Eocene representatives of the genus principally in showing less of a tendency

toward basining of the molar teeth, with a consequent cusp-crest predominance. Whether there is any progressive tendency on the part of *Sciuravus* to develop greater basining of the cheek teeth at successive geologic levels I do not know, since up to the present time no comparison of representatives of the genus from various Bridger horizons has been attempted. The Utah form appears less specialized than the Bridger Eocene species as regards this trend, but in other respects *Sciuravus eucristadens* m. seems somewhat aberrant when compared with the latter forms and might represent a divergent phlyetic branch within the genus.

MEASUREMENTS

	mm.
Length of cheek dentition (including P_4 alveolus)	9.7
Length of molar series	7.7
M_1 transverse	1.9
M_1 antero-posterior	2.4
M_2 transverse	2.1
M_2 antero-posterior	2.3
M_3 transverse	2.2
M_3 antero-posterior	3.0
Depth of lower jaw at M_1	5.5
Depth of lower jaw at M_3	5.8